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ABSTRACT

The current lag in U. S. productivity has many implications for vocational education. Before discussing the role of vocational education in easing the productivity crisis, it is necessary to understand the causes of the crisis. Included among these are rising energy prices; the segmentation of the American work force, by both geography and skills; high turnover due to lack of work readiness or to critical skill shortages in certain occupations; and the displacement of workers by automation. The solution to these problems lies in improved education and training. In response to the need for innovative and effective training techniques, the Control Data Corporation has developed a number of products and programs, including the following: (1) a competency-based computerized education system called PLATO; (2) a program to help chronically unemployed youth find and keep jobs (entitled Fair Break); (3) a campaign to train and place disadvantaged people in skilled career positions; (4) a program called HOMEWORK that allows the disabled and/or homebound to work at home through a network of computer terminals; and (5) twenty-four Control Data Institutes that provide essential job training in the fields of computer programming and maintenance. (MN)

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Occasional Paper No. 82

THE BUSINESS AND INDUSTRY PERSPECTIVE ON U.S. PRODUCTIVITY: IMPLICATIONS FOR VOCATIONAL EDUCATION

by

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PREFACE

As a nation that has experienced unprecedented economic growth in the past, America has recently become concerned about lagging productivity and its relationships with inflation and general economic decline. Business and industry, focal points of debates about increasing productivity, are extremely concerned both in terms of their livelihoods and in achieving social goals catalyzed by a healthy economy. To speak about productivity concerns of business and industry, Mr. Thomas W. Miller of the Control Data Corporation presented a seminar at the National Center.

Mr. Thomas Miller received a Bachelor of Science degree at the University of California. He has held numerous leadership positions, first as a U.S. Army officer in an Armor Division. He was a systems analyst and federal systems representative in the United States and Europe for RCA Corporation. He has been with Control Data Corporation (CDC) since 1965 where he has moved up from account representative to district sales manager, then to regional manager to vice-president of CDC. He has been vice-president for CDC's Professional Services, U.S. Operations, for the corporation's Education Division, and is currently Vice-President for Business Development.

The National Center for Research in Vocational Education, The Ohio State University, is proud to share Mr. Miller's observations in this paper entitled "The Business and Industry Perspective on U.S. Productivity: Implications for Vocational Education."

Robert E. Taylor
Executive Director
The National Center for Research
in Vocational Education

THE BUSINESS AND INDUSTRY PERSPECTIVE ON U.S. PRODUCTIVITY: IMPLICATIONS FOR VOCATIONAL EDUCATION

It was just over twenty-five years ago that Bill Norris founded Control Data Corporation (CDC) in Minneapolis. Since then, it has grown to fifty-eight thousand employees, worldwide, and the revenues last year were just short of $4 billion. In the business press we are described as a computer and financial services business, which is true; we do make and sell some of the world's most powerful computers, along with a full line of computer peripherals, and our Commercial Credit Company does offer the full range of financial services. But, as many of you know, that is only part of the picture. Control Data also has operations and projects underway in everything from farming in Alaska to urban revitalization in Toledo. One of our biggest efforts, which we expect will account for a large part of our business in the future, is education—particulary computer-based education.

We are already developing and marketing a full spectrum of computer-based courseware—everything from basic reading and math to advanced technical and vocational training, to advanced engineering and medical education—through our PLATO education system. I mention this because computer-based education is at the heart of the issues I would like to address today, and I will come back to it later in more detail.

As a CDC representative, I am speaking today from two general perspectives. The first is the point of view of a large employer concerned about the productivity of its own work force. The second is the point of view of a private sector provider of education and training, including vocational education.

My topic is the business and industry perspective on United States productivity and its implications for vocational education. As a business person, I can give you that perspective in one short question: Where is the payoff?

Business wants results. It wants them to be quantifiable, immediate, and profitable. Whether we are talking about an acquisition, a new product line, or a vocational training program, we are going to ask those same questions. Where is the payoff? How much? How soon? How do we make the most of it?

We have identifiable goals in business, and everything we do must be measured in terms of progress toward those goals. We are concerned primarily with profit, of course, although there are other things we strive for. There is always a danger when we see only profit. Sometimes we are shortsighted. We neglect long-term planning in favor of short-term profit, and we end up like some of the American steel companies, with old equipment, skyrocketing production costs, and a general lack of innovation.

So when I say, "Where is the payoff?" I do mean profit, but I also mean things such as planning, productivity, quality, knowledge, worker morale, and yes—even benefit to society. Mix these ingredients together and you get an analytic tool for business decision making, a pragmatic litmus test. As we talk about productivity, and about vocational education, these are the criteria by which to test our ideas in the business marketplace. At each step, we are going to want to know, Where is the payoff?

I have intentionally put my remarks in this pragmatic context, not only because I am a business representative, but also because economic and social factors dictate that *every* institution—public and private—should take a long, hard look at itself to understand how it operates. The institutions that survive are the ones that have a ready answer to the question, "Where is the payoff?"

With that as background, let me turn to the topic at hand: productivity and the implications for vocational education. Let me state my perspective succinctly: If the *problem* is productivity, the *solution* is education. That is the gist of my remarks today.

We all know that the productivity of American industry and American workers is declining. We know it because members of the press have been saying it almost nonstop for several years—and just after they say that, they usually point out how much productivity has increased in Japan. This statement suggests that evidence is forthcoming to debate the previous statements, but then the evidence doesn't come.

Several weeks ago, I mentioned to a colleague that I was invited to give this presentation. She asked what I was planning to say, and I replied that I was still thinking about it. She said, "Maybe you ought to just tell them the truth; we'll all be speaking Japanese in ten years."

She was only half-joking. There is evidence that our industrial output is lagging in relation to Japan's, and there are statistics that seem to prove that our average worker is less productive. But this does not really justify the almost universal acceptance of these conditions as fact. The question is, why do our statistics make us seem less productive?

One reason is the restructuring of our economy that's underway in response to rising energy prices. Since oil prices began to rise in 1973, there has been a steady shift *away from* manufacturing goods that require a lot of energy to produce or operate. Very few people are still buying the big, gas-guzzling cars, for example. We are moving away from outdated production methods that require a lot of capital investment and energy, and we are moving toward more efficient methods of production and energy use.

Technology and training applications will make the difference. In our economy, energy and labor are directly related, so as the price of energy rises, the demand on labor intensifies. Production must become more efficient, but this depends on how technology is applied, and that depends on how well training systems move the work force along with technology's advances.

A second reason for our productivity problems is the distribution of available labor. The American work force is segmented, both geographically and by skills. Although economy-wide employment may be generally up (or down), there are huge differences in different sectors around the country. I read recently, for example, that some computer companies in Houston are so desperate for employees that they are offering $2,500 bonuses to anyone who agrees to stay at least six months on the job. On the other hand, unemployment has hit 16 percent in Detroit, and you hear stories about several thousand people who show up hours early for a few job openings.

Two factors are at work here. One is the geographic shift of labor opportunities—generally, from the older, industrialized North and Northeast to the newer industries of the South and the Southwest. The other factor is the shift in labor skills—from those formerly required in the languishing steel, rubber, and auto industries, to the skills needed by the new booming high-technology companies. In the short run, these factors produce a lag during which the labor markets in different sectors shift and reorganize. It is expected that the new high-technology industries will eventually

create as many or more jobs than the number lost in other industries. But, these jobs will be in a different place, will require different skills, and will take some time before they achieve a balance in the labor market again.

In the interim, workers in older industries will be displaced while the new technology companies will not be able to find and keep enough skilled people. During this time—which we are in right now—overall productivity will flatten out. But in the long run, this shift toward technological innovation will make American business and industry much more productive and much more competitive in world markets.

Traditionally, this has always been true. Our greatest advances in productivity in *any* field have nearly always been the result of technological innovation. I make this point because it applies to us, as people concerned with vocational education. We will be responsible for teaching the new technologies. Equally important, we must look for the applications of new technologies in our own work.

The business of teaching, I think you will agree, has been immune to major changes—of any kind—for centuries, but now there are technological innovations that *are* affecting education. I am thinking specifically of computer-based instruction. As a business person, I think it combines increased efficiency, lower cost, and greater accuracy in the delivery of skills and knowledge. In other words, computer-based instruction is a technological innovation that increases productivity. As an educator, I see it as a valuable tool that lets me do or teach more, do it faster, and do it better. Either way, I see it as inevitable. As I mentioned earlier, computer-based education is at the heart of the issues I am addressing today, and I will come back to the subject again in a moment.

A third reason for declining productivity is high turnover. Among entry-level and unskilled employees, the cause is usually a lack of work readiness. Among highly skilled employees, it is usually a matter of being able to move from one company to another at will. It is a seller's market among highly skilled workers, which is why those Houston companies are dangling incentives to get and keep employees. The bottom line is the more turnover, the less sustainable productivity.

A fourth reason that American productivity looks as bad as it does is that as automation replaces many routine jobs, displaced workers need to develop new skills, but the training is not always available. For others, the training is long and costly. In either case, productivity lags.

There are dozens of other factors that influence productivity. I would include increased energy costs, underutilized resources (both human and physical), lagging innovation and use of technology, lagging capital investment, excessive government regulation and, most importantly, an unresponsive educational system.

To attack these causes on a microeconomic scale is clearly an immense challenge. But a qualitative change is simply the result of a lot of small quantitative changes. Productivity, you might say, begins at home. It begins in relatively small bits and pieces. So, let me address the issue on a microeconomic basis.

The same sort of statistics on nationwide productivity apply to individual American workers. Our output is down. Our productivity is declining. What can we do?

We can start by looking at what productivity is, and then about what strategies will enhance it. It is no longer realistic to approach productivity as a carrot-and-stick issue. You cannot make people do a better job than they are capable of doing. You cannot expect people to do jobs they do not have the skills to perform. And you certainly are not going to get more widgets off your assembly line by standing at the end and shouting, "Faster, faster."

What you can do, and what Control Data is attempting to do on a massive scale, both inside the company and out, is to *educate* and *train.* Give employees the education, the training, the job skills, and the environment necessary to achieve consistently good performance. In the final analysis, productivity is simply the *effective* utilization of human resources. It is enabling employees to explore the limits of their own potential, and giving them the tools to do it. The most important tool is education.

Bill Norris of CDC often tells the story of building his new energy-efficient home. During construction, all woodwork, stone masonry, and painting were done with obvious skill and care. All of the craftspersons had a mastery of their trades. They did meticulous work, and the results were outstanding. On the other hand, a lot of the mechanical and electrical work in the high-technology areas was shoddy. It became clear that the technicians simply were not skilled in the complex technologies of heat pumps, solar energy, and control devices. As a result, they did inferior work—and they seemed to be relatively unconcerned about it.

We have all had similar experiences with car repairs, or appliances, or what-have-you. In business, we have the same problems within our companies. In every case, the underlying cause is the same: inadequate training and insufficient education.

Substandard performance is nearly always linked directly to a lack of training and education. Inadequate skills to do a good job lead to despair, despair leads to apathy, and apathy results in shoddy performance and second-rate work. This equation is not limited to technical trades. It applies across the board. This is why I say, if the problem is productivity, the solution is education.

Within Control Data, for example, we are gearing up to provide as much as ten times the amount of traditional training—including delivery to nonmanagement people—over the next five years. The training will include the range of specific job skills, of course, but it will also involve a range of personal skills, such as time management, stress management, interpersonal communications, how to handle conflict, and so forth. All of these skills relate to eliminating different sets of barriers to productivity. The key to overcoming these barriers is the same key to providing technical skill competency: education.

A moment ago, I said business tends to blame declining productivity, in part, on an unresponsive educational system. There has always been some tension between business and education, and within industry there is a sense that now when it is most needed, education is becoming less effective. Educators, too, have their opinions of the responsibilities of business. Where do we go from here?

We are moving from the industrial age to an age of information and knowledge. The skill level necessary to function productively in work is increasingly a direct function of a person's education. And yet, there is a feeling that our schools are doing an inferior job. There are too many people out there right now without the basic skills necessary to get and hold even an entry-level job, and too many more without the skills necessary to master vocational or professional training. Without adequate skills and follow-through, a person is condemned to that cycle of despair, apathy, and poor performance.

At the postsecondary level, there is feeling that students are coming out overeducated and underpaid in terms of business. Recently, a survey came across my desk. It was a poll sent to corporate chief executive offices to ask their attitudes about higher education. The survey asked, "What do you think colleges' priorities are?" The answer was, self-preservation first. "What *should* their priorities be?" the survey asked. And the answers were: intellectual stimulation of students, and preparation of students for work roles in society.

The business people responded overwhelmingly that higher education owes it to students to help them develop marketable skills. But when they were asked whether colleges and universities are doing an adequate job of teaching young people today, 63 percent said no. (It is interesting to note, however, that almost every one of the business people had been approached by one school or another for a contribution.)

Two other survey responses are worth noting. More than half of the respondents said they would favor a partnership between universities and businesses in the granting of degrees. And fully 86 percent of them said they would be willing to help develop an undergraduate curriculum.

I think people in business are used to competition—to changing and innovating and moving ahead —and when they look at education, they see a static system, an institution whose basic processes have not really changed in a thousand years. Our natural inclination is to think we have outpaced traditional education, that it cannot or will not keep up with our needs. When we look at standard education and ask the question, "Where is the payoff?" there is not a convincing answer.

It is less true for vocational education, of course, but let us ask ourselves, "Where is the innovation? Where are the advances? What is the mission of vocational education, and is it meeting those goals?

I am reminded of another experience Bill Norris had. A number of years ago, he went to a university with a proposal to sell them Control Data's newly developed PLATO system, which they had been using for free for two years. The university decided it was not interested in taking the lead in computer-based education. What they wanted instead was an outright gift of a million dollars. Norris declined, saying Control Data would support only institutions willing to introduce new technology into the learning process.

So much for that . . . until two years later, when the university came to Norris again for money. This time, they were facing a crisis because of expanding enrollments and inadequate funds to hire new faculty. No money was donated, but Control Data did respond by noting that the school was trying to treat symptoms rather than causes. The problem of expanding enrollment *can* be addressed without increases in faculty and salaries, but *only* through the introduction of new technology into the education process as a way to increase productivity. And, of course, Control Data had already tried to help the university do just that years earlier with PLATO.

The university regretted not getting money, and this time it said it would be interested in talking about PLATO. Today, it is integrating PLATO courses for credit.

The moral of the story, I think, is that there seems to be a strong resistance to change in education. Every other institution is looking for innovations and technological advances, but education—which needs these things desperately—has generally not made the connection. It will, eventually, of course. And when it does, industry will have already laid the foundation.

Let me turn now to some specifics. As I have said, if the problem is productivity, the solution is education. Let me add to that. If the problem is productivity, the solution is pragmatic, innovative, technologically oriented *vocational* education.

I would like to present a profile of Control Data's experience in this area. As you know, we are in the position of being both a customer and a provider of vocational education. We have also developed a number of unique programs that—if I can present them briefly—will give you an overall feel for our perspective.

PLATO

First and foremost, there is PLATO, our computer-based education system. It consists of more than seven thousand hours of instruction (courseware), along with education-specific software and techniques to help present materials in a highly efficient manner to students. Control Data began to develop PLATO in 1962 and, as I mentioned, we expect it eventually to become the largest segment of our business.

PLATO is quick, accurate, and easy to use. It has infinite patience, an unlimited memory, and each student gets personal attention and immediate feedback. I should point out here that the PLATO system is a teaching tool, and a method of enhancing educational productivity. It is not necessarily a teacher replacement. Because it can provide standardized, competency-based instruction on virtually any topic to any number of people, PLATO is designed to augment the teaching process and enhance a teacher's effectiveness.

PLATO courseware runs the gamut from basic grade-school-level reading and grammar to advanced business management instruction and nuclear plant operator training. There are lessons on economics, math, engineering, electronics, music, and hundreds of other topics, with more being added all the time. The system is currently being used for everything from job training for disadvantaged young people to cockpit flight simulation for airline pilots. It is adaptable to virtually any subject and any level of expertise. What's more, it is not expensive. It costs about $450 per hour for airline pilots to use a flight simulator. It costs them about $8 per hour to use the PLATO system.

And, perhaps most importantly, using PLATO works. The PLATO Basic Skills program, for example, has taught functionally illiterate young people how to read and write in the toughest of environments—places such as Berendo Junior High School in Los Angeles. Several years ago, Berendo was a rundown building in a poor part of town where nobody wanted to be. It was filled with kids from broken homes, kids from over twenty nationalities, tough kids who ran with gangs, kids who spoke almost no English. The average eighth grader read at a third-grade level. Students were discouraged. The school board considered closing the school. But by last year, Berendo had turned around. It is now a thriving model school that is winning achievement awards. The reasons are innovative leadership on the part of the principal, Rosalyn Hyman, and use of new teaching technology such as PLATO.

In 1978, Berendo Junior High leased eight PLATO terminals, and during the next school year, four hundred students spent ten weeks each using the system. The students had differing aptitudes and abilities, and they used PLATO to study basic math, reading, and language. An article on Berendo set the scene this way:

> Sitting at a PLATO terminal learning about basic fractions, a Berendo student sees graphic illustrations, text, and animation on the computer screen. The student tries problem-solving and types in the answer. Right or wrong, the feedback is instant. "Terrific," the computer says. "On to the next problem," or "No, try again." If the student doesn't understand, the computer reviews the fraction lesson . . . and won't move on until it's understood.

All along, the learning experience is one-to-one: private, patient, with no pressure, no "audience," and very supportive. In other words, the technology of education is being properly applied.

Each of the students at Berendo used PLATO for a half hour every day. According to a teacher at Berendo, "When the half hour was up, no one wanted to give up their machine. We had kids coming in after school, asking if they could stay and work with the terminals. Others asked to pick up more computer time during lunch and other classes. Our kids really thought they were special if

they were chosen to work on the computer . . . and they lived up to the honor." The bottom line at Berendo was results. The students using PLATO averaged two-and-a-half years' growth in reading in less than a year. Other programs using the PLATO system to teach basic skills report similar results.

In Baltimore, twenty-four functionally illiterate adults advanced almost a full grade level in reading after twenty-two hours of instruction; fifteen of those instruction hours were on PLATO. Another forty-nine students advanced more than a grade level in math after only thirty hours of instruction on PLATO. In Florida, two hundred students advanced an average of a full grade level after just fourteen hours. And so on. So when we ask ourselves, "Where's the payoff?" we have the answer.

Fair Break

PLATO works not only as an educational tool, but as a vocational and personal skill-building tool. It is the foundation of a number of applications aimed at youth unemployment and job preparation.

One of these applications, which Control Data began in 1978, is called Fair Break. Its purpose was—and is—to help chronically unemployed young people find and keep jobs. It has grown to a national level, with more than thirty-five hundred young people participating across the United States. Based upon our experience with other human services, we knew at the outset that Fair Break would have to address the underlying problems and barriers to employment. We would have to look at people as whole persons. What specific skills do they need to get a job? Do they suffer from lack of self-esteem? Do they have family problems? Do they lack the basic tools of literacy? Do they know how to cope?

Problems like these are at the root of unemployment. If they are not dealt with, they fester below the surface, undermining any attempt at job training—any attempt to treat the symptoms rather than the real needs.

In designing Fair Break, Control Data staff identified four employment barriers common to young people, and put together ways to break them down. One of our most effective tools in doing so was PLATO. One of the barriers, for example, was work readiness. Many people simply cannot read or write or handle basic math well enough to function in a work place. For them, we provided the individualized basic skills program through PLATO, which I have described.

Another barrier to employment is a lack of job-finding skills. Here the PLATO system is used for courses on career planning and job-seeking techniques. For up to four months, Fair Break students spend an average of two hours a day working on PLATO courseware as part of the program. They are learning remedial and world-of-work skills, along with basic technical skills aimed at specific, employer-identified jobs.

When they graduate, young people can look forward to the kinds of results already shown past Fair Break graduates:

83 percent of the graduates have gone directly to a job or to vocational training.

73 percent of those placed in jobs were still working after six months.

90 percent of Fair Break graduates have taken and passed their high school equivalency exams.

When we ask where the payoff is, we have the answer: Fair Break. Using the PLATO system as its primary tool for courseware and managed instruction, chronically unemployed young people can be successfully trained and prepared for entry-level jobs. There is no doubt about it!

ACET

Control Data has shown that the same approach can be used to train and place disadvantaged young people in skilled, *career* positions as well, through the ACET program. ACET is a federally funded program, and stands for Advanced Career Employment and Training. Control Data participated in ACET beginning in 1979, and over a three-year period we will recruit, train, and guarantee employment to 300 disadvantaged young people from around the country.

ACET offers intensive career—and I emphasize *career*—training of eight to fourteen months, leading to a skilled position as a computer technician. The computer industry is expected to hire tens of thousands of these technicians over the next five years, so ACET students can expect to enter the field with job stability and a salary that will make them self-supporting. The typical ACET student comes from a background of economic or educational disadvantage, and has no job skills. He or she goes to class four hours a day at Control Data, and might work part-time for Control Data during training.

In Control Data's ACET program, students all live in a renovated hotel in downtown Minneapolis, where a full range of support services are provided, from counseling and legal assistance to tutoring. It is a twenty-four-hour living and working environment, and it is based on our belief that helping people become job-ready is as important as having a job for them to go to. What we are trying to do is not to scrub people up in order to get them into menial jobs, but to take the time and trouble to get them the personal and job skills necessary for a continuous employment position. To do that, we have to go after the root causes of unemployment, and once again, our major tool is PLATO.

In the ACET program, students use PLATO far beyond just basic skills training. They use it for technical training in computer programming and customer engineering. By the end of their training, they are able to move directly into career positions in industry. They also use PLATO for the Fair Break personal skill training mentioned earlier.

Where is the payoff? So far, 97 percent of those students placed in jobs are still there. And most of them, I am sure, would report improvements in their lives and in their outlooks for the future.

HOMEWORK

PLATO also makes possible another Control Data program I would like to mention. It is called HOMEWORK, and it began just a few years ago. It was then that we started to realize the enormous costs to the company of employees who became disabled and homebound—costs both in dollars and in lost expertise. Across the country, there are now more than two million homebound adults—whether because of handicaps, illness, or social dependence—many of whom were once productive, loyal workers. We can also see that this is costing United States taxpayers more than $750 million every month to maintain disabled workers on Social Security. And for the people with disabilities, there are very painful problems of loneliness, boredom, and monotony. It is not that these people can no longer work—they simply cannot *get* to work.

At Control Data, many of our disabled employees were long-term workers with talent, expertise, and knowledge of the company. We decided to see if we could recapture those resources, and give those people a way to return to work. What we did was to install PLATO terminals in the homes of volunteers, and to use the PLATO system to retrain them in work they could do on the terminals—programming, for example, and courseware development. HOMEWORKers would sign on and work at their own pace.

In the end, everyone benefitted. Control Data was able to recapture the talents and abilities of some very good people, and the HOMEWORK volunteers were able to do meaningful, paying work. They discovered a link with the outside world, and a way to become productive again. The program has been so successful that it has formed the basis of an emerging alternate work-site program for other employees who will be working at home. As shortages of skilled people develop during the eighties, we cannot afford to overlook these potential labor markets.

CDI

Control Data's experience with more traditional vocational education goes back to the early sixties. In those days, there was a great shortage of skilled computer technicians. Those who could be found had been trained in the military, or had been to a vocational school for two years. At the time, it was generally accepted that you needed two years of schooling to become a technician. Even so, Control Data had to train newly hired technicians for several more months, on company time. So the company decided to start its own school, based on the premise that nine months should be adequate to learn the essentials of entry-level computer programming and maintenance. The school was named Control Data Institute (CDI). Now, eighteen years later, there are thirty-four CDIs around the world.

Providing only the essential training to do the job is a keystone in the CDI approach. Career training for a high school graduate requires money and time. Many are undecided about their career directions even if they have the money, and of course, most are financially constrained. CDI offers the opportunity to start a vocational career in a minimum amount of time. After CDI, other options for advanced education or different careers are even more available. Today, a typical Control Data vocational school makes an adequate profit, and enrollment is growing. The placement rate for CDI graduates is over 95 percent. So here too, we have answers to the question, "Where is the payoff?"

Let me mention briefly three other programs we are involved in. Career Readiness and Outreach are programs to introduce vocational education and job preparation into secondary schools, with the idea of reducing the dropout rate by encouraging vocational and higher education. The City Venture program, which is a comprehensive urban revitalization business, makes use of several education and job-training components of our other programs.

These examples are just part of the picture at Control Data, but they illustrate some of the issues we feel are important. Vocational education must present itself competitively, like any other product in the marketplace. Training should be geared to a specific job objective. Only the essential knowledge for a particular task should be taught. The practical and "need-to-know" should take precedence over the "nice-to-know." Not only must vocational education respond to the private sector's need for increased productivity, it must increase its own. The way to do that is through the introduction of innovation and technology into the learning process. For Control Data, that means computer-based education—PLATO.

Vocational education should constantly ask itself, "Where is the payoff?" We must not be training auto mechanics when industry needs computer technicians. We have to invest in tomorrow's jobs, not yesterday's. Part of the responsibility for this lies with industry. Companies have to perceive and articulate their own needs clearly to vocational education. We both have to communicate.

Let me put everything I have said in the context of the Control Data business strategy. The essence of it is: To address society's major unmet needs as business opportunities. Instead of offering products and services and then creating a desire for them, Control Data looks at needs that already exist and tries to find business solutions. We are applying our computer software and educational technology to such needs as better health care, affordable energy-efficient housing, more and cheaper energy, lower food costs, revitalized inner cities, and job opportunities for people with disabilities.

Control Data has programs underway in each of these areas—*not* because we are a charitable organization or a social agency. We are not. We are in business to make money. Although some of these programs may seem like the "right" thing to do, they are also expected to make a profit.

There is more than one path to the bottom line, and Control Data has chosen to get there by addressing society's needs. And as I think you will agree, some of our most pressing needs are for education, jobs, and job training. We need better, more available, and more affordable education at all levels, especially for young people. We need more and better jobs, and effective training in real job skills. The role of vocational education is to attack these problems aggressively, effectively, and with the best tools available. The result will be not only a more productive economy, but better lives for the people we reach.

In closing, let me leave you with this thought—a quote from Edward Denison of the Brookings Institution: "In the final analysis, advancements in the application of knowledge are the only true source of productivity."

QUESTIONS AND ANSWERS

Thomas W. Miller

Question: You listed several factors, including education and skill training, as solutions to the need for increased productivity. Can you put the importance of education and skill training into perspective as to their roles in raising productivity?

Education and skill training are components of every factor related to increasing productivity. As you look at each factor, I think you'll find that education can provide leverage to make that factor more effective. If we can properly apply education and skill training to address any one of the factors of productivity, we should be able to see a 30-40 percent improvement. If we apply educational technology in the right way, we should be able to see considerable improvement in the productive environment that each particular factor represents.

Question: What do you find are the best ways to stimulate people to avail themselves of education and training provided by a company or by vocational education institutions?

Research on that shows that it is really a management problem. It is a management problem that is shared between educators and the people in a particular business sector, be that in a community or in a particular company. If students see that they can better themselves by going through a vocational education program, then they will do that. There also have to be jobs at the completion of the program that relate to the environment in which those people want to work. The skill training must fit those particular areas. If we approach any particular area in too much of a generic fashion—if the fit is not as good as it should be, and the management of the training process has not presented students with a very clear picture as to what they can get out of it—student motivation will be lower than it should be.

The solution is obvious. We have a management problem that requires the specificity of training to be stated, the payoff to be obvious, and a job to be available at the end of that process.

Question: Since the late forties and early fifties, technology has been used better by Japan than by the U.S. to manufacture products. But so far, microcomputers have largely been produced in the United States. What will happen with the manufacturing of microcomputers as their use expands?

That question has a particular relevance to vocational education research and development, because there has been a proliferation of microcomputers. As we examine the microcomputer market today, these computers are essentially made in the United States. Ninety-seven-plus percent of the micros that you see in the advertisements on television, and in books and magazines, are United States made. But you can bet that there are Japanese business people throughout the United States, with their notebooks and cameras, gathering all the information that is available today about micro-

computers. You can also bet that in not too many months, maybe a year or so, Japan will introduce microcomputers in the United States. So, I think the Japanese are going to be a substantial factor in the personal computer market, and that will happen very soon. The reason is that the Japanese have very good ability to make hardware. They can make electronic hardware of extremely high quality.

As we look at this development relative to vocational education research and development, I think that it also represents an opportunity. It will take the Japanese a long time to catch up with us in developing programming and computer-based education material for the microcomputer. The Japanese can churn out the hardware, but it is estimated that they are twenty years behind the United States in software and courseware. So, both business and vocational education have the opportunity to use American software and courseware to provide vital education and skill training. This also gives importance to training workers as programmers, sales representatives, maintenance and repair technicians, and so forth. I expect the demand for those kinds of skilled workers to increase rapidly in the very near future, which will place a greater burden of training on business and vocational education.

Question: When will it be practical to offer computer-based instruction at school and in the home, based on the cost of hardware and software?

I think we're going to recognize very soon that hardware is secondary to the delivery of quality computer-based education. In other words, I think we're moving into an area that will not require us to offer computer-based education on only one company's equipment.

If a company is going to be successful, it ought to recognize that a proliferation of software is taking place. As a consequence, we must develop software materials that can be used with different microcomputers. Control Data is moving toward development of very powerful methods that allow computer-based education materials to be developed without dependence upon hardware. We are also building software and educational technology within our PLATO system, with the objective of its being hardware-independent.

Question: If you were to give the presentation ten years from now, what new technology, would you say, would be having the most impact in the computer business?

Artificial intelligence will become one of the most useful computer capacities and will have impacts on our lives and businesses in ways that are hard to imagine. Once we understand and imbed the technology we have today, the application of the technology of software or courseware will occur through machine inferencing called "artificial intelligence."

Control Data's plans for the development of courseware, software, and computer-related applications will provide tools in the next two years that should drive the costs of development down by a factor of four. That means we are going to be able to develop software or courseware in about one-quarter of the time that we develop it today. Artificial intelligence should provide an additional productivity factor of ten for the development of software, courseware, and other computer-related applications.

Question: You have mentioned a wide range of Control Data Corporation activities. Would you you describe the company's size and the number of people involved in these activities?

The company has about fifty-eight thousand employees around the world. We have a ratio of approximately one manager to ten employees, so there are about six thousand managers. Each manager is required to take forty hours of education training on PLATO every year, and each is required to determine what new programs should be made available. The new programs are then presented to other employees, and are organized and managed so that upgrading takes place.

Between three and four thousand people are trained at the entry level at Control Data Corporation by computer-based education every year. Also, over the next five years we will be increasing, by a factor of ten, the computer-based education and training materials that will be presented to nonmanagerial people. So as we have it today, we have a well-defined program for managers, and we have a well-defined program for entry-level people. Of course, most of our corporate population is in between, so the next five years will really see the application of our training from the entry level to incorporate higher levels, and we'll be stepping down from the management level to incorporate those lower levels so that over a five-year period we will really include the whole company. There will be minimum requirements for computer-assisted education and training every year for every person in the company. That's a fairly massive program, because it will require much management, structuring, and development of materials to make it happen.

Question: In working with hard-core unemployed adults, we've found that computer-assisted instruction seems to become boring to them after a few months. Has Control Data Corporation done anything to deal with this problem?

A component of computer-based education using the PLATO system is called Fair Break. Our Fair Break program is focused on the group to which you refer. In addition to the PLATO component Fair Break also has consultation and on-the-job training components. The basic level of skill training at first is practically 100 percent PLATO. Then, after about three months, consultants assist these students practically every day. As soon as the students are able to handle very menial tasks, even on a part-time basis, they are helped to reach out to the work place. We augment the computer component so that boredom does not set in after a period of time.

The computer component is fun for a while, but then it does get a little old. About the time that starts to happen, we take the students through a consultative process that aids them in understanding what niches they might be able to fit in. For example, they might be counting something, or they might be evaluating some shipment. Some basic work experience, such as standing beside someone in a full-time job, is begun. Through these kinds of experiences the work place identity starts to come into play.

This Fair Break program goes on for six to nine months for an individual, depending upon how fast that individual responds. So Fair Break really is a combination of PLATO, consulting, and beginning elements of on-the-job training.

Question: How are teachers trained to integrate computer-based instruction within the regular curriculum, and how is the success of such a program measured?

The teacher training requirement is a big problem. What we have learned over the last few years, through the promotion and sales of PLATO, is that you must advertise, conduct seminars, and do mailings to provide information. But we found that even more is needed, so we also have a sales force of people across the country who are charged with calling on schools in their particular territories to inform and educate teachers and administrators. This is a very expensive way to sell computer-based education, but at this point in time, this people-intensive approach seems to be the best way to do it.

Where we encounter combinations of teachers and administrators who are relatively innovative and willing to take a step in a nontraditional direction, it is easy to train teachers to use computer-based education. However, there is a tremendous resistance in the secondary teacher community to employing new technology. They may be afraid of losing their jobs. So we have to approach many schools somewhat indirectly.

Earlier, I talked about Control Data's basic skills, job readiness, and entry-level skills programs. Some of those programs are imbedded within school systems. We have become involved with some school systems as a result of being under a CETA contract or some other contract in the community. Where we do get involved, and where the teachers do use computer-based technology in their classrooms, they become very supportive of the technology. We can then draw upon those teachers to speak out in their own communities. There is progress, but it is agonizingly slow.

We have programs in postsecondary institutions that help us reach out into the high school arena. One of our postsecondary programs has to do with teaching engineers or aspiring engineers in the freshman and sophomore levels of college. This program provides an outreach to the high schools in those areas because the high schools must try to provide math and science courses that support the engineering curricula in the colleges. There again, it is an indirect approach and, there again, where the technology is applied and teachers integrate it into their programs, the feedback is positive. But the resistance is still there. We're going to continue that kind of strategy.

At the same time, we are encouraged that schools are buying microcomputers, and are providing some degree of computer literacy in secondary school environments. We hope that will lead to the schools' recognition that educational technology and computer-based technology are important. That whole market is beginning to percolate with those kinds of activities.

I imagine that there will be other new directions in education that will emerge in the next couple of years. I think microcomputer proliferation will have an important role, which can be viewed as a problem or viewed as an opportunity. I clearly see it as the latter.

How do we measure the success of these programs? Schools using our programs were asked to get up studies that placed PLATO in one group and traditional methods in another control group. It turned out that we were able to measure the effects of PLATO very effectively.

There are many ways to measure a program's success. You can measure progress, you can look at grade level, you can use pretests, you can look at the amount of progress in between them. The application of good technology provides some very nice tools. But to set up a traditional control group is very subjective, so we ask each educational institution to provide us with the necessary information. A lot of our data are subjective. Some information is the opinion of teachers and administrators who serve on steering committees or advisory boards. Essentially, they assess the level of achievement of students in the control group. This information is subjective, and we have to depend on the school system to provide us with the comparison data. If the information seems valid, then we accept it.

Question: Is Control Data Corporation involved in the design of computer specialist and engineer training for computer applications called Computer Aided Design and Computer Aided Manufacturing (CAD/CAM)?

The answer to that is yes, a strong yes. Our computer systems division, the portion of our company that builds and sells large computer systems, has as part of its responsibility the provision

of a large and expensive application for CAD/CAM. CAD/CAM is a very large umbrella under which there are many applications. We are dealing primarily with machinery manufacturers and the computer tools that are necessary to their particular manufacturing requirements. We are heavily into the use of CAD/CAM with automobile manufacturing, with farm machinery companies, and many others.

We have a steering committee made up of executives and engineers from six corporations that advise us on what the ingredients of our products should be. The decisions that we make internationally, as to where to put our development dollars in a given year, are based on the advice from these companies and on a market analysis we conduct within our company. We give a large degree of importance to the advice from our steering committee.

PLATO is imbedded in our CAD/CAM development process in three ways. First of all, as we develop a CAD/CAM element of our application, training is provided before an engineer uses that CAD/CAM system. Such engineers would learn to use PLATO, which would then lead them to the use of the CAD/CAM application.

Second, as engineers go through that learning process they may run into difficulties in a particular area. They can call for assistance from the computer. What happens at that point is that PLATO material is called up on the computer for the specific area in which the engineers are having difficulty. It leads them through a little learning process without losing their place in the application process.

Third, PLATO is being applied as a consultative resource. In other words, through the use of the PLATO system, CAD/CAM engineers can have access to any consultants in Control Data, anywhere in the country. So, instead of sending out one of our analysts to help an engineer with a problem that engineer can get to an analyst instantly through a terminal. That saves us both money and time, and it also provides the customer with faster service. We feel that those three elements present a major payoff for using PLATO technology to aid in CAD/CAM applications.

Question: What effects will the recent restructuring of the American Telephone and Telegraph (AT&T) system have on the PLATO system, since PLATO uses the telephone?

A number of our PLATO product offerings are off-line, stand alone, and do not depend upon a telephone line. The proliferation of microcomputers in the future will offer a "stand alone" delivery vehicle upon which we can also present PLATO. Other PLATO product offerings depend on the telephone. AT&T is a fairly large organization though, and as it changes its structure, it will have a monumental training problem. AT&T is doing an absolutely massive reorganization. But, the AT&T organization is more conservative than most bankers, and there is considerable resistance to change. When this major reorganization happens, it will absolutely tear asunder some of the structure within AT&T's operating companies. There is a tremendous training need that emerges from that.

The Bell System has organized a massive training program that deals with some of these needs. That is going to involve a very large, ongoing program for many years to come. And, I am delighted to say that Control Data's PLATO products are a large part of their training plans. They have no problem with the costs of telephone lines, so that presents us with more pluses than minuses.

Question: Do you have software and courseware developers on the staff of Control Data Corporation?

We have a fairly large staff of people who deal with the discipline of courseware. One important problem is deciding what courseware to build. If we are dealing with AT&T, we generally deal with them on a consultative basis. We take the specifications that they provide and build courseware to fit those specifications. If we're talking about courseware for basic skills, or human engineering skills, and so forth, Control Data staff specify content for the developers for building a course. Certainly that's true in my organization, CDC's Business Development arm, where we have a lot of these development functions broken down, and in every case there is a market requirement identified.

Question: Is it better to have technical computer specialists develop courseware with the help of subject matter specialists, or the reverse?

We are dealing with a mixture of skills. We're dealing with subject matter experts on one hand, and people who are more computer-oriented on the other. We've found that we have to have both types of expertise involved. One of the first things we do at Control Data, once we decide to build a piece of courseware, is to search out the appropriate subject matter expert. Usually that means looking outside the company. We may find these experts in business, industry, and universities, or a research institute such as the National Center. Once we have acquired a manuscript from this person that specifies content information, we use designers, programmers, and implementers in computer-oriented disciplines to develop the actual PLATO courseware.

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